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AUTHOR Campbell, George, Jr.; And Others
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ABSTRACT

A study was done to compare the success of undergraduate engineering schools in graduating minorities from their programs. The study developed the following three parameters that can be used to define the performance of engineering schools in graduating minorities: (1) graduation rates of minorities; (2) graduation rates of minorities relative to those of non-minorities (the Relative Retention Index); and (3) absolute number of graduates. The study used national enrollment and graduation data supplied by 118 individual institutions. Findings indicate that only 35.6 percent of the minority freshman engineering majors studied had obtained a bachelor of science in engineering degree, while the rate for non-minorities was 68.4 percent. When minority graduation rates were recalculated beginning with a sophomore year baseline, the study found that minority sophomores were retained at rates somewhat better than freshmen, with 56.7 percent of them graduating, while almost 87.4 percent of the non-minority sophomores graduated. The study also conducted intrainstitutional comparisons of graduation rates of minorities and variation in rates by ethnicity. Included are 5 graphs, 13 tables, and 2 appendices containing 2 tables of Engineering Manpower Commission data. (JB)

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NACME Research Letter
December 1991 Volume 2, Number 2

Minority Graduation Rates

Comparative Performance of American Engineering Schools

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TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

George Campbell Jr., Ronni Denes, Douglas L. Friedman, Lynn Miyazaki

Highlights

- Nationally, only 35.6 percent of the freshmen from underrepresented minority groups who enroll in engineering graduate, compared to 68.4 percent of nonminority engineering majors (Table 1, Figure 1).
- Among those who make it into the sophomore year, 56.7 percent of minorities and 87.4 percent of nonminorities graduate (Table 1, Figure 1).
- While colleges achieve widely varying results with minority sophomores, nonminorities who survive the freshman year tend to be a stable population, independent of school.
- Of the 118 schools for which complete freshman retention rates could be computed, only nine schools had rates for minorities at or above the 68.4 percent gross national rate for nonminority students (Table 2).
- On six campuses, minority freshmen graduated at a rate virtually equal to or higher than that of nonminority students on the same campus (Table 6).
- Fifteen schools had above average performance in each of the measures examined, i.e., above average graduation rates for minority freshmen and sophomores, 35.6 and 56.7 respectively; above average relative retention indices, 52.0 and 64.9 respectively; and above average number of graduates annually, 13 (Table 9). Unfortunately, the enrollment of minority students at many of these schools is small.
- Based on data reported to the EMC, 62 of the 325 engineering schools produced no minority engineering graduates during the academic years from 1983-84 through 1989-90.
- One of every seven engineering colleges with statistically significant data attracted more than 15 percent of its average cohort class through the transfer process. This inflates the apparent graduation rates of those schools.

The enrollment of minority freshmen in engineering schools has skyrocketed, growing 49.0 percent from 1986-87 through the 1990-91 academic year. Increases occurred for each of the underrepresented groups (African Americans, 42.5 percent; Hispanics, 60.2 percent; American Indians, 49.0 percent), at a time when the number of nonminority students choosing to major in engineering fell 10.5 percent. Unfortunately, only one of every three minority students who enrolls in engineering earns a BSE degree. The success rates at different engineering schools, however, vary dramatically.

Overview

To compare the success of individual institutions, we calculated and analyzed three parameters that can be used to define the performance of engineering schools in graduating minorities: (i) graduation rates of minorities, (ii) graduation rates of minorities relative to nonminorities, for which we define a new measure, the Relative Retention Index (RRI) and (iii) absolute number of graduates (see Computing the Graduation Rate, page 3).

Based on national enrollment and graduation data averaged over a decade, we found that only one out of three (35.6 percent) minority freshman engineering majors obtains a bachelor of science in engineering degree (BSE). For nonminorities, the rate is two out of three (68.4 percent). Statistically, a minority student entering engineering school is only about half as likely (52.0 percent) to obtain a BSE as a nonminority student.

To find out what happens to those students who survive into the sophomore year, we recalculated minority graduation rates beginning with a sophomore year baseline. We found that minority sophomores were retained at rates somewhat better than freshmen, with slightly more than one out of two graduating (56.7 percent), while almost nine out of ten (87.4 percent) nonminority sophomores graduate. The relative success of engineering schools in graduating minorities who have achieved sophomore status compared to nonminorities who have gotten to the sophomore level improves to 64.9 percent. Though the relative improvement is significant, the gap remains wide.

Minorities constituted a very small percentage of engineering schools' annual graduates – an average of 5.6 percent over the period included in this study or, excluding the Historically Black Colleges and Universities (HBCUs), only 5.0 percent. Looking at

George Campbell Jr., Ph.D., is president, Ronni Denes, vice president, communications and public affairs, Douglas L. Friedman, Ph.D., director, research, and Lynn Miyazaki, research associate, for the National Action Council for Minorities in Engineering, Inc.

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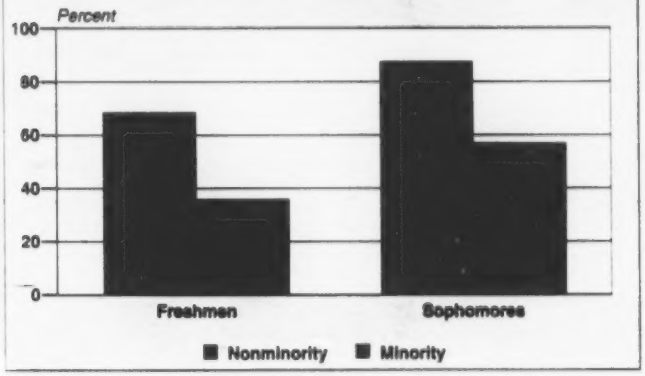
Figure 1.
Aggregated National Graduation Rates



the individual engineering colleges, we find a highly skewed distribution where a relatively small number of schools produce the bulk of the minority graduates. Only about one-third (29.8 percent) of the nation's engineering schools graduated the national average of 13 or more minorities, and only one in 14 (7.1 percent) graduated 50 or more minorities annually (Table 8, Figure 2).

After filtering out the colleges where there was incomplete data, where the numbers were statistically insignificant and where the results were skewed by an influx of transfer students, we still found evidence of wide variation in performance. Using the algorithm detailed on page 3, we were able to compute well-defined freshman minority graduation rates for 118 schools. Of these:

- Nine graduated minorities above the gross national rate of 68.4 percent for nonminorities (Table 2);
- Six graduated minority freshmen at a rate equivalent to or better than nonminority engineering students on the same campus (Table 6); and
- Fourteen graduated an average of 50 or more minority engineers per year (Table 8). (An additional nine institutions with 50 or more graduates did not have data that met our criteria for inclusion in the 118.)

Typically, engineering colleges with the highest minority graduation rates and highest relative retention indices were not among the schools producing the largest number of total minority graduates. It follows that the schools producing large numbers of minority engineers don't have the best retention performance. This has important policy implications. It suggests that a focused effort on increasing retention at the relatively small number of schools already producing the lion's share of minority engineers can improve the national graduation figures substantially.

Only 15 schools among the 118 performed in the top category across all five measures of success – above average minority graduation rates for freshmen and sophomores, above average relative retention indices for minority freshmen and sophomores and above average number of minority graduates per year (Table 9).

The RRI allows us to compare minority and nonminority retention at the same institution. Very few schools have an RRI near or greater than 100 percent, indicating that those successful with minority students are still *somewhat* more successful with nonminorities on an absolute scale. However, it's important to keep in mind that, on average, engineering colleges do much better with nonminorities. Looking over Tables 6 and 7, we see very few schools with both high minority and high nonminority graduation rates relative to the respective national averages.

When ethnic data are disaggregated, we find that African American freshmen graduated at a rate slightly less than half (44.8 percent) that of nonminority students. For American Indians it was slightly more than half (52.1 percent). Hispanics graduated at nearly two-thirds (65.5 percent) the rate of nonminorities.

Table 1.
National Aggregate Graduation Rates and Relative Retention Indices*

	Freshmen	Sophomores
Minority Graduation Rate	35.6%	56.7%
Nonminority Graduation Rate	68.4%	87.4%
Relative Retention Index	52.0%	64.9%

*Includes only schools with complete data. Excludes the University of Puerto Rico.

National Graduation Averages

From 1980 to 1986, the average annual enrollment of minority engineering freshmen was 10,670, or 9.8 percent of the total freshman enrollment of 108,909. For the sophomore cohorts, the average was 6,811, or 8.1 percent of the total of 83,639. Tracking the progress of these classes four to six years later, an average of 4,121 minority engineering students graduated annually. This represents 5.6 percent of the 73,106 average number of total graduates over the same period. These average annual enrollments and graduations are based on all 325 schools included in EMC reports (Appendix A). The graduation rates, however, were derived through an analysis of only those schools with complete data (see Computing the Graduation Rate, page 3 and Appendix B).

Freshmen. The national average minority graduation rate, based on freshman enrollments, was 35.6 percent, compared with 68.4 percent for nonminority students (Table 1, Figure 1). The ratio of these two rates is a measure of how the nation's schools performed with minorities relative to nonminority students, an indicator we've defined as the Relative Retention Index (RRI). The gross national average RRI for freshmen indicates that minorities graduated at 52.0 percent of the rate of nonminority freshmen.

Sophomores. To examine what happens to those students who complete the freshman year or who enroll in engineering as sophomores, we also computed rates for the sophomore class. When the national graduation rate is based on sophomore enrollments, 56.7 percent of minority and 87.4 percent of nonminority students graduate (Table 1, Figure 1), an RRI of 64.9 percent. This indicates that minority sophomores are more closely aligned with their peers than freshmen. That is, all students who survive into the sophomore year are more likely to graduate, as we might expect, and, at the sophomore level, the performance of schools in graduating minority students gains relative to that for nonminorities. Nonetheless, universities still only graduate minority sophomores at two-thirds the rate of nonminority sophomores. In fact, the graduation rate for minority sophomores does not even reach that of nonminority freshmen.

Graduation Rates by Institution

Freshman Graduation Rates. Of the 138 schools* used in the analysis of freshmen, we found 118 to have data that met the criteria for inclusion (see below). Figure 3 shows the distribution of minority graduation rates among these engineering schools.

The freshman-based minority graduation rates for this selected sample of 118 schools can be fit approximately to a normal distribution with

$$\mu = 37.0$$

and

$$\sigma_{n-1} = 17.4$$

where μ and σ are the mean and standard deviation, respectively. The spread of the distribution, i.e., the variation in performance, measured by σ is fairly broad. Seventy percent of the population have graduation rates within one standard deviation of the mean, i.e., between 19.6 and 54.4. Schools with minority graduation rates above 72 percent ($\mu+2\,\sigma_{n-1}$) are among the top 5 percent in performance.

It is very interesting that the mean of this sample, where those schools with significant numbers of transfer students have been removed, is slightly *higher* than the gross national aver-

*Only schools with annual average freshman enrollments of at least 10 minority students were included in the school-by-school comparison data base.

Computing the Graduation Rate

To compute an aggregate graduation rate for the 1980s, we developed an algorithm comparing total freshman enrollments from the 1980-81 through 1985-86 cohort years to total graduations from the 1983-84 through 1989-90 cohort years. This averaging algorithm inherently smooths out anomalies associated with variations in the amount of time different students take to graduate. For sophomores, we used the same algorithm, except that the initial enrollment year was 1981-82, to complement the 1980-81 freshman year, and the final year was 1986-87, to complement the 1985-86 freshman year.

The large number of enrollments and graduations stabilize the national graduation rate, as computed with our algorithm, despite fluctuations in enrollments associated with incoming transfer students. This provides a decade of the 1980s perspective on the retention performance of the nation's engineering schools.

In the individual school calculations, the graduation rate is quite sensitive to the influx of transfer students. Schools that acquire engineering majors after a first cohort year will have an overstated freshman graduation rate. Students enrolled after the second year will affect the sophomore rate similarly. We, therefore, filtered out institutions with especially skewed rates by first examining changes in enrollment between the freshman-to-sophomore and sophomore-to-junior classes and then making judgments about the degree of confidence that these changes imply. In the aggregate, for all schools in the sample, there was a decrease of 37.1 percent from the average minority freshman-to-sophomore class (from 9,784 to 6,151) and a 13.4 percent decrease from the minority sophomore-to-junior class (from 6,151 to 5,325). Nationally, the average percent decrease in minority enrollment from the freshman-to-sophomore class was 36.2 percent (from 10,670 to 6,811) and 9.1 from the sophomore-to-junior class (from 6,811 to 6,192).

While the change in class size from entering freshmen to upperclassmen decreases nationally, individual schools often show significant growth between the freshman and successive years. We considered it possible to compute a meaningful graduation rate only if the average increase in enrollment for freshmen and sophomores was less than 15 percent. Individual school graduation rates must still be interpreted cautiously. Even when overall enrollments declined from the sophomore to junior year, the addition of the small number of students who transfer from two-year colleges, who declare an engineering major after the freshman or sophomore year, who participate in dual-degree 3/2 programs and who ultimately graduate may slightly underestimate the actual attrition of freshmen or sophomores.

Data Bases

In computing graduation rates,* only schools with complete enrollment and graduation data were included. Schools without complete data were excluded in order not to distort the graduation rates.

*All data in this report are derived from EMC annual enrollment and graduation surveys, unless otherwise noted.

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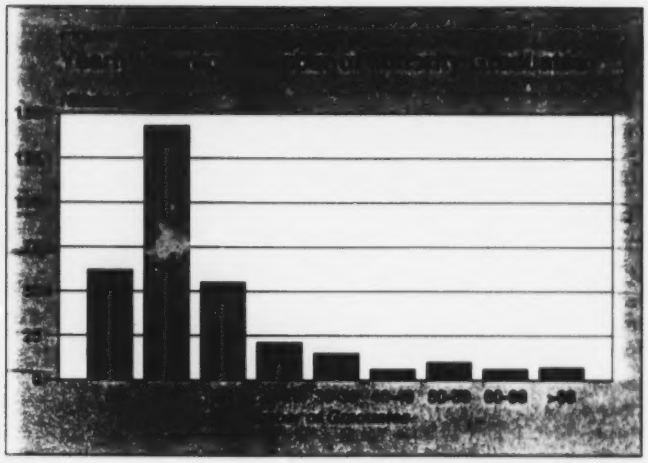

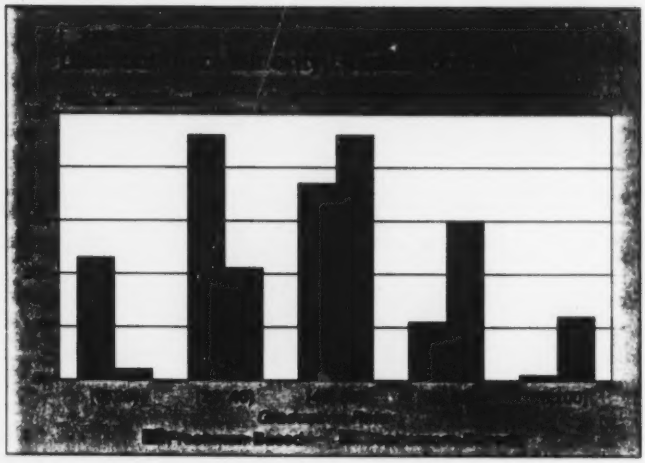

age, which does include junior college transfers, as well as students who declared themselves engineering majors after the freshman year.

Among the 118 schools, 20 had inflated *nonminority* graduation rates because of transfers. Eliminating those, the mean and standard deviation of the nonminority graduation rate for the 98 remaining are:

$$\mu = 65.4$$

and

$$\sigma_{n-1} = 18.1$$

and 70.4 percent of this population have nonminority graduation rates between $\mu \pm \sigma_{n-1}$, 47.3 and 83.5. Here the mean is statistically equivalent to the gross national average.

Other significant findings include:

- Only nine schools had minority graduation rates exceeding the 68.4 percent gross national rate for nonminority freshmen (Table 2).

- Of the 138 schools analyzed, 19 that appear to have minority graduation rates higher than the national average actually have inflated rates because of the influx of transfer students (Table 3).

- Many of the schools with the highest minority graduation rates were among those with the most stringent admissions policies. Based on admissions difficulty as defined in *Peterson's Guide to Four-Year Colleges, 1990*, 37.3 percent of the schools in Table 2 with above average graduation rates were considered "Most Difficult" or "Very Difficult."

- Many of the schools with high graduation rates have low minority enrollment.

Sophomore Graduation Rates. Based on minority sophomore graduation rates, 111 of the 129 schools* in the sophomore sample had appropriate data permitting them to be included (Table 4, Figure 3).

Assuming that sophomore-based minority graduation rates for this selected sample of 111 schools also approximate a normal distribution,

$$\mu = 54.5$$

and

$$\sigma_{n-1} = 18.9.$$

Sixty-eight percent of the population have graduation rates within one standard deviation of the mean, i.e., between 35.6 and 73.4.

*Only schools with annual average sophomore enrollments of at least 10 minority students were included in the school-by-school comparison data base.

Among the 111 schools, 14 had inflated *nonminority* graduation rates because of transfers. Eliminating those, the mean and standard deviation of the *nonminority* graduation rates of the remaining 97 are:

$$\mu = 83.9$$

slightly less than the gross national average, and

$$\sigma_{n-1} = 14.8$$

which indicates a very narrow distribution. Seventy-three percent of the population have nonminority sophomore graduation rates between 69.1 and 98.7, $\mu \pm \sigma_{n-1}$. That is, the performance of schools is much more consistent for nonminority sophomores than for either minority freshmen, minority sophomores or nonminority freshmen. The high graduation rate for nonminority sophomores together with the small variation among schools indicates that nonminority engineering majors who have completed the freshman year constitute a relatively stable group.

Other significant findings include:

- Only seven schools had minority graduation rates at or above the 87.4 percent gross national sophomore rate for nonminority students. Five other schools had minority graduation rates that exceeded 80 percent (Table 4).

Table 2
Engineering Programs Ranked by Graduation Rate and Minority Enrollment*

	Graduation Rate (%)	Percent Change in Minority Enrollment: Freshman to Sophomore	Percent Change in Minority Enrollment: Sophomore to Junior
U Bridgeport	85 7	13 6	-26 7
George Washington Univ	78 4	-15 9	-4 3
Northwestern University	75 7	9 2	-12 2
Tulane University	74 4	-22 3	9 6
Johns Hopkins University	72 4	-27 3	-14 3
Florida Institute of Tech	72 0	14 9	-32 4
U Miami	71 8	-24 7	11 2
Princeton University	71 4	-5 6	-20 6
U Cal-Berkeley	69 3	-10 0	2 6
Marquette University	66 7	1 4	-18 3
U Alabama-Huntsville	65 8	1 4	0 0
U Maryland-College Park	62 4	-33 1	11 6
U Minnesota	56 9	-18 4	3 9
Stevens Inst of Tech	55 7	-18 1	-35 7
Purdue Univ-W Lafayette	55 2	9 5	-33 1
Rice University	55 0	-38 1	-31 3
U Mississippi	53 7	-18 7	0 0
Rensselaer Polytechnic	53 7	-26 2	-8 3
U Delaware	53 1	-4 2	2 2
U Michigan-Ann Arbor	52 6	-16 2	-15 5
Tennessee Tech Univ	52 6	-36 8	-34 3
Purdue Univ-Calumet	51 4	-35 7	-31 1
U Pacific	51 1	-24 5	-8 5
U Detroit	50 7	-5 8	-54 9
U Colorado-Boulder	50 4	-46 3	1 1
Texas A&I University	50 3	-42 3	3 7
Drexel University	50 1	-25 5	-32 9
U Louisville	49 7	-40 0	-18 3
U Missouri-Rolla	49 2	-34 9	-5 3
Cleveland State Univ	48 5	-38 2	-10 6
Colorado State University	48 3	-45 4	-1 5
Cornell University	47 2	-15 7	-32 6
US Naval Academy	46 7	-32 1	-21 8
U Pennsylvania	46 2	-2 7	-19 2
U Mass-Amherst	45 9	-10 6	6 8
+ Tuskegee University	45 3	-8 1	-17 4
Cal State U-Los Angeles	44 5	-42 6	11 2
GMI Engrg & Mgmt Inst	44 1	-26 7	-23 1
SUNY-Buffalo Campus	43 6	-34 5	0 9
Lehigh University	43 3	-2 8	-50 0
+ U District of Columbia	42 9	-26 9	-22 9
NC State Univ-Raleigh	42 7	-19 3	-12 2
Colorado School of Mines	42 6	-31 2	-20 6
Vanderbilt University	42 5	-24 0	-17 3
U Virginia	42 2	-38 2	-7 4
U Cal-Los Angeles	42 0	-40 4	3 9
Kansas State University	40 6	-34 0	-13 1
Syracuse University	40 3	-30 7	-19 3
Loyola Marymount Univ	40 1	-39 8	-16 5
U Southern California	39 2	-14 8	-18 3
Virginia Poly Institute	39 2	-23 4	-22 9
U Tennessee-Knoxville	37 8	-54 9	-5 8
U Illinois-Champaign	37 6	-42 1	-9 3
Northeastern University	37 4	-56 1	13 8
Brown University	37 0	-37 6	-27 9
Virginia Military Inst	36 7	-41 8	-22 6
Rochester Inst of Tech	36 3	-37 0	8 6
NM Institute of Mining	35 6	-53 9	-7 3
Cal State U-Northridge	35 6	-15 4	-16 5
Rutgers University	34 4	-32 8	-21 4
+ NC A&T State University	34 1	-36 4	-17 9
U Pittsburgh	33 9	-11 9	-53 1
U Cal-Santa Barbara	33 7	-50 8	-5 2
+ Howard University	33 3	-57 4	-12 6
U Notre Dame	33 2	-50 3	-16 3
U Wisconsin-Milwaukee	33 1	-33 3	-44 0
Clemson University	32 5	-29 7	-19 0
Illinois Inst of Tech	32 3	-45 4	-19 2
Penn State University	32 1	-34 4	-31 8
+ Prairie View A&M Univ	31 7	-36 3	-12 9
U South Carolina	31 4	-49 5	-12 9
U Alabama	31 0	-39 3	-16 6
U Wisconsin-Madison	31 0	-26 9	-32 3
So Illinois-Carbondale	30 8	-26 9	-15 8
Boston University	29 7	-29 7	-24 2
U Michigan-Dearborn	28 6	-20 0	-38 1
Ohio University	28 2	-55 3	-17 6
U Cincinnati	28 2	-46 4	-18 7
Lawrence Technological U	28 1	-48 3	-32 5
Auburn University	28 1	-39 3	-58 4
+ Southern University	27 5	-9 3	-50 6
U New Mexico	27 1	-48 5	-37 9
U Rochester	26 6	-36 6	-44 4
U Arkansas	25 7	-28 4	-44 2
U Cal-Irvine	25 7	-45 9	-22 8
NM State University	25 4	-39 5	-26 8
Arizona State University	25 0	-40 7	8 7
U Texas-Austin	24 9	-48 0	-23 6
U Kansas	23 6	-48 6	-31 8
U Alabama-Birmingham	22 2	-47 2	-44 2
U Arizona	22 0	-52 9	-25 9
Wright State University	21 7	-47 0	-8 5
U NC-Charlotte	21 7	2 5	-28 4
U Kentucky	21 4	-44 8	-3 8
Oklahoma State Univ	20 2	-50 6	-19 0
Christian Brothers Coll	19 8	-30 0	-46 4
U Texas-Arlington	19 7	-53 4	5 8
U Connecticut	19 3	-39 6	-56 6
U Texas-El Paso	19 3	-47 0	-28 5
Memphis State University	19 1	-26 4	-13 2
+ Tennessee State Univ	18 6	-35 8	-24 7
U Illinois-Chicago	18 5	-58 2	-19 0
Embry-Riddle U-Daytona	18 1	-41 3	-45 9
Iowa State University	17 4	-61 5	-29 8
U Missouri-Columbia	17 1	-55 9	-13 7
U Houston	16 5	-44 4	-23 8
CCNY (City College, CUNY)	15 7	-61 9	-11 7
Western Michigan Univ	15 2	-41 6	-48 5
U Southwestern Louisiana	14 6	-50 7	-41 5
U Oklahoma	13 5	-51 3	-38 4
Michigan State University	13 5	-49 4	-62 5
U Toledo	13 4	-63 9	-61 4
Ohio State University	13 2	-61 9	-29 5
Louisiana State Univ	10 8	-76 2	-4 3
U South Alabama	9 8	-58 9	-11 1
Oakland University	6 9	-39 4	-72 3
Indiana Inst of Tech	6 2	-77 3	-36 4
U Akron	5 7	-63 6	-50 0

*Selection Criteria: 1) Only schools with complete data. 2) A yearly average minority freshman class of at least 10. 3) Increases in minority freshman-to-sophomore and sophomore-to-junior enrollments do not exceed 15%.

+HBCU

- Eighteen schools in the overall sample had increases in minority sophomore-to-junior enrollments in excess of 15 percent (Table 5). These schools are effective in attracting a large number of minority students who did not begin their studies there as freshmen. However, the influx of transfers obscures their sophomore graduation rates.

- Forty of the 46 schools with above average graduation rates for sophomores (Table 4), also had above average graduation rates for freshmen (Table 2). A substantial majority (87.0 percent) of the schools effective with sophomores, then, tend to be successful with freshmen. The reverse is also generally true. There are, however, examples of disparate performance. Comparing the retention of sophomores and freshmen at individual institutions provides useful insights which have policy and program implications.

Table 3.
Engineering Colleges with Greater Than 15% Increase in Minority Freshman to Sophomore or Sophomore to Junior Enrollment*

	Freshman-based Minority Graduation Rate (%)	Percent Change in Minority Enrollment	
		Freshman to Sophomore	Sophomore to Junior
Cal Poly-Pomona	87.8	-24.0	63.8
Cal State U-Fresno	44.7	-2.6	73.7
Cal State U-Long Beach	71.8	-42.0	105.9
Cal State-Fullerton	89.7	24.6	87.7
Case Western Reserve Univ	65.9	25.6	-41.8
Columbia University	63.7	21.9	-44.6
Georgia Inst of Tech	68.7	-17.0	25.0
Manhattan College	103.8	3.2	25.5
Michigan Tech University	45.7	-43.5	34.6
Mississippi State Univ	56.2	-0.5	24.9
Old Dominion University	54.1	-42.3	46.7
Pratt Institute	209.5	45.7	71.2
San Diego State Univ	43.7	-43.7	63.5
San Jose State University	79.9	-8.6	36.2
Texas A&M University	46.8	-36.0	19.1
U Central Florida	42.1	-51.3	109.8
U South Florida	99.1	-22.8	80.9
U Washington	42.7	-26.8	28.6
Washington University	80.7	-9.3	23.1

*Selection Criteria: 1) Only schools with complete data. 2) A yearly average minority freshman class of at least 10. 3) Freshman-based minority graduation rates above the national rate of 35.6%.

Relative Retention Index
Intra-institutional comparisons of graduation rates of minorities versus nonminorities provide insights of a different kind. To make these comparisons, we defined the Relative Retention Index (RRI):

RRI=(Minority graduation rate/ Nonminority graduation rate) x 100

Freshman RRI. In this analysis, we eliminated schools with significant transfers of either minorities or nonminorities. Ninety-eight institutions met the criteria for inclusion in the freshman analysis. The mean RRI for this population was 55.1, very nearly equal to the gross national average of 52.0. The relatively large standard deviation of 23.2 indicates a wide variation in this parameter.

- Six schools had freshman RRIs of 95 or higher, indicating that they were doing as well, within the statistical margin of error, or better with minorities than nonminorities (Table 6).

Sophomore RRI. For sophomores, 97 institutions met the standards for inclusion, yielding a mean of 64.2 and a standard deviation of 22.5. The stability of the nonminority sophomore population suggests that the large variance here is due to widely varying performance of schools in graduating minority sophomores.

- Six schools did better with minority than with nonminority students (Table 7). Of these, four schools had both freshman and sophomore indices above 95 percent; one was an HBCU. Figure 4 shows the distribution of RRIs among the engineering colleges.

Number of Graduates by Institution
As a final measure of performance, we compared the number of minority graduates at each school. As mentioned earlier, an average of 4,121 minorities graduated annually during the last seven years, 5.6 percent of the average class of 73,106. This yields an average by school of 13 minority graduates, compared to 223 nonminority graduates. Of the 325 engineering schools, only 97 (29.8 percent) equaled or surpassed the national yearly average of 13 minority graduates. Only 23 schools graduated 50 or more minority engineers. This highly skewed distribution is exhibited in Figure 2. Table 8 lists the average number of graduates for each school. Unfortunately, many of the schools with good minority retention rates have low minority enrollment, and many of the schools that graduate a large number of minorities have low retention rates. As we've noted, these observations have important strategic implications.

Variation by Ethnicity
African Americans comprised more than half (53.8 percent) of the yearly average minority graduates. Hispanics 42.9 percent and American Indians 3.3 percent (Figure 5). Freshman- and sophomore-based graduation rates for African Americans are 30.6 percent and 50.0 percent. Hispanics 44.8 percent and 70.2 percent, and American Indians 35.6 percent and 59.1 percent, respectively. The respective RRIs indi-

Table 4.

Engineering Colleges Ranked by Sophomore-Based Minority Graduation Rate*

	Graduation Rate (%)	Percent Change in Minority Enrollment Sophomore to Junior
Tulane University	95.7	9.6
U Miami	95.3	11.2
U Colorado-Boulder	93.9	1.1
U Maryland-College Park	93.3	11.6
George Washington Univ	93.2	-4.3
Rice University	88.8	-31.3
Colorado State University	88.4	-1.5
Texas A&I University	87.2	3.7
Northeastern University	85.1	13.8
U Tennessee-Knoxville	83.7	-5.8
Tennessee Tech Univ	83.2	-34.3
U Louisville	82.9	-18.3
+ Howard University	78.0	-12.6
Cal State U-Los Angeles	77.6	11.2
U Cal-Berkeley	77.0	2.6
Princeton University	75.6	-20.6
U Missouri-Rolla	75.5	-5.3
U Bridgeport	75.4	-26.7
Rensselaer Polytechnic	72.8	-8.3
U Cal-Los Angeles	70.4	3.9
U Minnesota	69.7	3.9
Northwestern University	69.4	-12.2
US Naval Academy	68.7	-21.8
U Cal-Santa Barbara	68.5	-5.2
U Virginia	68.3	-7.4
Stevens Inst of Tech	68.1	-35.7
U Pacific	67.6	-8.5
Drexel University	67.3	-32.9
U Notre Dame	66.8	-16.3
Loyola Marymount Univ	66.6	-16.5
SUNY-Buffalo Campus	66.5	0.9
U Mississippi	66.0	0.0
Marquette University	65.8	-18.3
U Illinois-Champaign	65.0	-9.3
U Alabama-Huntsville	64.9	0.0
Ohio University	63.0	-17.6
U Michigan-Ann Arbor	62.8	-15.5
Florida Institute of Tech	62.7	-32.4
U South Carolina	62.3	-12.9
Colorado School of Mines	61.9	-20.6
Kansas State University	61.5	-13.1
GMI Engrg & Mgmt Inst	60.2	-23.1
Brown University	59.2	-27.9
Illinois Inst of Tech	59.0	-19.2
+ U District of Columbia	58.6	-22.9
Syracuse University	58.2	-19.3
Cornell University	56.0	-32.6
Vanderbilt University	56.0	-17.3
U Delaware	55.5	2.2
SUNY-Stony Brook Campus	54.7	10.5
Lawrence Technological U	54.3	-32.5
U Detroit	53.9	-54.9
+ NC A&T State University	53.6	-17.9
NC State Univ-Raleigh	52.9	-12.2
U Cincinnati	52.6	-18.7
U New Mexico	52.6	-37.9
Case Western Reserve Univ	52.5	-41.8
Columbia University	52.3	-44.6
U Mass-Amherst	51.3	6.8
Rutgers University	51.2	-21.4
U Alabama	51.2	-16.6
Virginia Poly Institute	51.2	-22.9
Purdue Univ-W Lafayette	50.4	-33.1
+ Prairie View A&M Univ	49.7	-12.9
+ Tuskegee University	49.3	-17.4
Penn State University	49.0	-31.8
U Texas-Austin	47.8	-23.6
U Cal-Irvine	47.5	-22.8
U Pennsylvania	47.5	-19.2
U Arizona	46.6	-25.9
Clemson University	46.3	-19.0
Auburn University	46.3	-58.4
U Southern California	46.1	-18.3
U Kansas	45.8	-31.8
Louisiana State Univ	45.6	-4.3
Iowa State University	45.1	-29.8
Lehigh University	44.5	-50.0
U Illinois-Chicago	44.3	-19.0
U Wisconsin-Madison	42.4	-32.3
U Texas-Arlington	42.4	5.8
Boston University	42.2	-24.2
Arizona State University	42.1	8.7
NM State University	42.1	-26.8
Cal State U-Northridge	42.1	-16.5
U Alabama-Birmingham	42.0	-44.2
CCNY (City College, CUNY)	41.3	-11.7
Wright State University	41.0	-8.5
Oklahoma State Univ	40.9	-19.0
U Missouri-Columbia	38.7	-13.7
U Pittsburgh	38.5	-53.1
U Toledo	37.2	-61.4
U Texas-El Paso	36.4	-28.5
U Arkansas	36.0	-44.2
U Michigan-Dearborn	35.7	-38.1
Ohio State University	34.7	-29.5
U Connecticut	32.0	-56.6
Embry-Riddle U-Daytona	30.9	-45.9
Carnegie Mellon Univ	30.7	-3.3
+ Southern University	30.3	-50.6
U Houston	29.6	-23.8
U Southwestern Louisiana	29.6	-41.5
+ Tennessee State Univ	29.0	-24.7
Christian Brothers Coll	28.3	-46.4
U Oklahoma	27.8	-38.4
Michigan State University	26.7	-62.5
Memphis State University	26.0	-13.2
Western Michigan Univ	26.0	-48.5
U South Alabama	23.8	-11.1
U NC-Charlotte	21.2	-28.4
U Akron	15.7	-50.0
Oakland University	11.4	-72.3

*Selection Criteria: 1) Only schools with complete data. 2) A yearly average minority sophomore class of at least 10. 3) Increases in minority sophomore-to-junior enrollments do not exceed 15%.

+ HBCU

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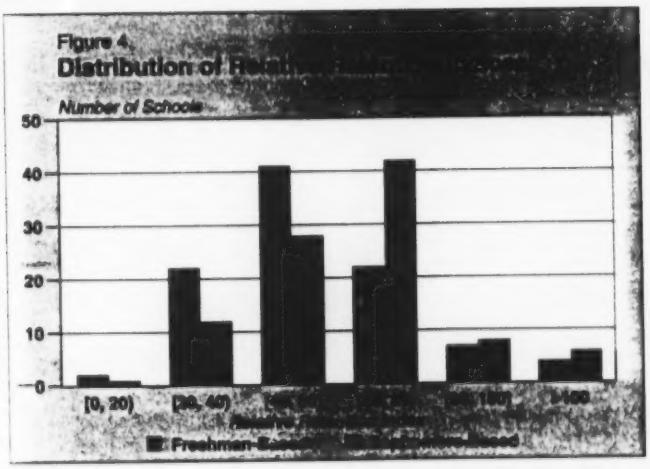

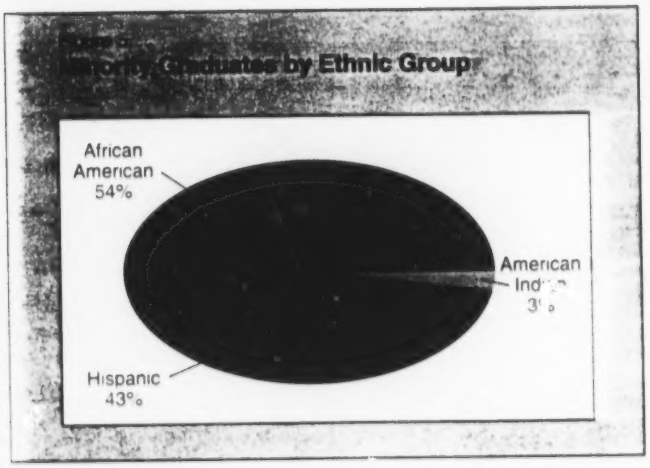

cate that African American freshmen graduate at 44.8 percent of the rate at which nonminority freshmen graduate and 57.2 percent of the rate for nonminority sophomores. For Hispanics the RRIs are 65.5 and 80.3 percent and for American Indians 52.1 and 67.6 percent, respectively.

A large proportion of African Americans graduate from Historically Black Colleges and Universities. Annually, the HBCUs graduate 25.8 percent of all the African Americans who receive BSEs, and they account for seven of the 12 institutions graduating at least 25 African American engineers annually (Table 10).

While Hispanics and American Indians are not as concentrated in particular schools, 14 institutions conferred at least 25 BSE degrees annually to Hispanics (Table 11). A significant number of schools attract a large influx of Hispanic students as transfers between the sophomore and junior years (Table 12). It is noteworthy that the University of Puerto Rico, Mayaguez, has graduated an average of 452 engineers annually during the period of this study. The inclusion of this data, however, would have obscured the achievement of all other engineering schools relative to the Hispanic population.

Only four schools averaged more than one percent American Indian graduates annually (Table 13). Because of the small numbers, it's difficult to draw significant conclusions about the performance of engineering schools with American Indian students.

Conclusions and Recommendations

The data that universities provide to the Engineering Manpower Commission (EMC) annually is, of course, imperfect. Moreover, the only way to measure retention with absolute accuracy is to follow each individual student longitudinally. Nonetheless, EMC's data base is the best, most comprehensive source of information available on engineering enrollment and graduation, and a comparative analysis spanning a ten-year period provides enormously rich and valuable insights.

Perhaps the most significant insight is one that is already well known, that American engineering schools have not served their minority student populations well, certainly not nearly as well as they have served their nonminority engineering students. That attrition of minority freshmen is twice that of nonminorities and that this situation has persisted for at least a decade, represents a catastrophic failure of the academic community to meet its responsibility in this area.

A mitigating factor and a disadvantage of our computations is that progress being made as a result of recently established retention or minority engineering programs at a number of institutions is obscured. There is also preliminary evidence suggesting that retention of minorities has improved slightly on a national level in recent years, but not enough to alter the conclusion of the preceding paragraph.

While a few strident voices on the national scene attribute minority attrition to the misguided interpretation of affirmative action as a lowering of standards, the data suggest otherwise, at least with respect to engineering. Far from being deficient in academic training and preparation, the African American, Hispanic and American Indian students who enroll in the nation's engineering schools are an extraordinarily select group of young men and women. Based on a statistically significant sample of students, we've found that minority engineering majors leave high school with grades and SAT scores indistinguishable, on average, from those of their white and Asian peers – and yet they drop out of engineering school at double the rate of their classmates.

The argument that this group of minority students may be disproportionately placed, relative to their educational development, in the more competitive institutions is also suspect. Almost 40 percent of the schools with the highest minority graduation rates have admissions policies that are among the most stringent.

In any case, other factors that serve as impediments to the success of minority

Table 5.

Engineering Colleges with Increase in Minority Sophomore to Junior Enrollment Exceeding 15%*

	Sophomore-based Minority Graduation Rate (%)	Percent Change in Minority Enrollment Sophomore to Junior
Cal Poly-Pomona	115.5	63.8
Cal State U-Long Beach	123.8	105.9
Cal State U-Sacramento	73.0	131.4
Cal State-Fullerton	72.0	87.7
Georgia Inst of Tech	82.8	25.0
Harvard University	93.2	16.4
Manhattan College	100.6	85.5
Old Dominion University	93.7	46.7
Pratt Institute	143.8	71.2
San Diego State Univ	[illegible]	63.5
San Jose State University	67.3	36.2
Texas A&M University	73.1	19.1
U Central Florida	56.5	109.8
U South Florida	128.3	80.9
U Washington	58.3	28.6
Washington University	94.0	23.1

[illegible]

students in engineering school are clearly operating and must be addressed more effectively than they have been in the past, if universities are to be considered successful as institutions of higher learning in the future.

A somewhat serendipitous observation, which can be made from the data and requires further study, is that those schools (e.g. some of the California institutions) attracting significant numbers of *nonminorities* through articulation relationships with two-year colleges do not seem to attract comparable numbers of minority transfers. It is also noteworthy that a majority of the HBCUs attract a substantial fraction of their nonminority graduates through the transfer process.

It must not be overlooked that, examining the data on a school-by-school basis, we see a number of individual successes which could serve as standards for the nation. The commitment of these institutions to educating minority engineers is reflected in graduation rates that exceed the rate for nonminority students nationally, minority graduation rates comparable to or even exceeding the rate for nonminority students at the same institution, and numbers of engineering degrees granted to minorities annually that exceed the national average. Their performance offers the remaining institutions a set of benchmarks that must be matched more broadly; in particular, retention of minority students at least equal to that of other students (68 percent for freshmen and 87 percent for sophomores), along with specific time lines and clear-cut responsibility and accountability for achieving these modest goals.

Another important recommendation that emerges from the study is that an intense effort should be devoted to improving retention at those institutions that already graduate a large number of minority students. At the same time, those schools with high minority retention rates, which in many cases have a small percent minority student enrollment, should intensify their outreach and recruitment efforts. The return on investment in both categories is likely to be high.

As the nation's largest privately funded source of scholarships for minority engineering majors, NACME has a critical stake in the ability of colleges and universities to provide an environment conducive to the success of underrepresented students. This report is the second in a series planned to develop a comprehensive analysis of the retention problem (See NACME Research Letter, *Volume 1, Number 1, "Minorities in Engineering School, A Data Base for Retention Efforts", April 1990). We will continue to analyze and report on effective strategies for retaining minorities in order to facilitate replication. Our goal is to assist colleges and universities as they begin to conserve and nurture the minority talent in each year's freshman class. The next report will analyze contributions of minority engineering programs (MEPs), the result of a joint NACME/ETS (Educational Testing Service) research project. And, in a recently published monograph titled* Retention By Design, *Dean Raymond B. Landis, of California State University, Los Angeles, discusses effective program strategies with demonstrated results. Future studies will examine such institutional factors as curriculum innovation, financial aid, and faculty sensitivity to diverse student populations.*

Table 6.

Engineering Colleges Ranked by Freshman-Based Relative Retention Index*

	Relative Retention Index (%)	Graduation Rate (%)	
		Minority	Nonminority
Purdue Univ-Calumet	130.8	51.4	39.3
- Howard University	129.3	33.3	25.7
Tulane University	116.5	74.4	63.9
Florida Institute of Tech	114.5	72.0	62.9
George Washington Univ	99.1	78.4	79.1
Tennessee Tech Univ	97.7	52.6	53.8
Cleveland State Univ	93.5	48.5	51.9
U Bridgeport	90.4	85.7	94.8
U Louisville	88.1	49.7	56.4
Marquette University	87.8	66.7	76.0
Stevens Inst of Tech	83.0	55.7	67.1
U Minnesota	79.9	56.9	71.3
Northwestern University	79.3	75.7	95.4
SUNY-Buffalo Campus	79.2	43.6	55.0
Texas A&I University	77.8	50.3	64.6
Princeton University	77.8	71.4	91.8
U Delaware	77.2	53.1	68.8
Brown University	74.8	37.0	49.4
Kansas State University	73.2	40.6	55.4
U Colorado-Boulder	72.9	50.4	69.2
U Mississippi	70.3	53.7	76.4
U New Mexico	69.0	27.1	39.2
Purdue Univ-W Lafayette	68.6	55.2	80.5
Drexel University	68.0	50.1	73.7
Colorado School of Mines	66.1	42.6	64.4
U Pacific	65.0	51.1	78.6
Virginia Military Inst	64.3	36.7	57.1
U Texas-El Paso	63.4	19.3	30.4
Loyola Marymount Univ	62.3	40.1	64.3
U South Carolina	60.5	31.4	52.0
U Alabama	60.3	31.0	51.5
U Detroit	60.1	50.7	84.4
Colorado State University	60.0	48.3	80.4
Rice University	59.4	55.0	92.5
GMI Engrg & Mgmt Inst	59.2	44.1	74.4
Johns Hopkins University	58.3	72.4	124.2
U Missouri-Rolla	57.6	49.2	85.3
Vanderbilt University	57.6	42.5	73.9
U Tennessee-Knoxville	56.7	37.8	66.7
U Mass-Amherst	56.2	45.9	81.7
Rensselaer Polytechnic	56.0	53.7	95.9
U Southern California	55.4	39.2	70.8
U Arkansas	55.3	25.7	46.5
Penn State University	55.3	32.1	58.1
Clemson University	53.2	32.5	61.2
U Virginia	53.1	42.2	79.5
NM State University	52.0	25.4	48.9
Syracuse University	51.6	40.3	78.2
Ohio University	50.3	28.2	56.1
- Tuskegee University	50.3	45.3	90.1
Northeastern University	50.0	37.4	74.8
U Cal-Santa Barbara	49.9	33.7	67.5
Virginia Poly Institute	49.9	39.2	78.5
U Notre Dame	49.7	33.2	66.8
Auburn University	49.6	28.1	56.6
U Pennsylvania	49.0	46.2	94.2
Cornell University	48.1	47.2	98.1
NC State Univ-Raleigh	47.9	42.7	89.1
U Kansas	47.2	23.6	49.9
Rochester Inst of Tech	46.6	36.3	78.0
U Wisconsin-Milwaukee	45.9	33.1	72.3
Lawrence Technological U	45.4	28.1	62.0
Arizona State University	43.6	25.0	57.4
Rutgers University	43.5	34.4	79.1
U Rochester	43.3	26.6	61.4
U Texas-Austin	43.1	24.9	57.8
Boston University	42.1	29.7	70.4
U NC-Charlotte	42.1	21.7	51.6
Memphis State University	42.1	19.1	45.5
U Cincinnati	42.1	28.2	67.0
Illinois Inst of Tech	41.7	32.3	77.4
U Toledo	41.0	13.4	32.7
U Texas-Arlington	40.5	19.7	48.8
Christian Brothers Coll	40.2	19.8	49.3
U Wisconsin-Madison	39.7	31.0	78.1
Oklahoma State Univ	38.2	20.2	52.9
Embry-Riddle U-Daytona	36.0	18.1	50.3
U Cal-Irvine	35.0	25.7	73.4
U Michigan-Dearborn	34.8	28.6	82.1
So Illinois-Carbondale	34.8	30.8	88.4
U Arizona	34.3	22.0	64.0
Iowa State University	33.5	17.4	52.0
Louisiana State Univ	32.9	10.8	33.0
U Southwestern Louisiana	32.2	14.6	45.4
Wright State University	32.0	21.7	68.0
Ohio State University	31.4	13.2	42.1
U Kentucky	30.3	21.4	70.8
U Alabama-Birmingham	30.3	22.2	73.3
Michigan State University	30.1	13.5	44.8
U Oklahoma	29.5	13.5	45.8
U Connecticut	28.9	19.3	67.0
Indiana Inst of Tech	27.5	6.2	22.5
Western Michigan Univ	26.7	15.2	56.7
U Houston	26.6	16.5	61.9
U South Alabama	24.8	9.8	39.5
U Missouri-Columbia	23.3	17.1	73.3
U Akron	16.8	5.7	34.1
Oakland University	7.5	6.9	91.3

*Selection Criteria: 1) Only schools with complete data. 2) A yearly average minority freshman class of at least 10. 3) Increases in freshman-to-sophomore and sophomore-to-junior enrollments do not exceed 15% for either minorities or nonminorities.

- HBCU

Table 7.
Engineering Colleges Ranked by Sophomore-Based Relative Retention Index*

	Relative Retention Index (%)	Graduation Rate (%)	
		Minority	Nonminority
+ Howard University	173.4	78.0	45.0
Tulane University	126.2	95.7	75.8
George Washington Univ	110.0	93.2	84.7
Tennessee Tech Univ	109.8	83.2	75.7
U Colorado-Boulder	103.0	93.9	91.2
Colorado State University	101.8	88.4	86.8
U Louisville	95.2	82.9	87.0
Stevens Inst of Tech	90.3	68.1	75.4
Rice University	89.0	88.8	99.8
Texas A&I University	88.5	87.2	98.5
US Naval Academy	88.0	68.7	78.1
Brown University	87.8	59.2	67.5
Northeastern University	83.6	85.1	101.8
U Tennessee-Knoxville	81.6	83.7	102.7
Drexel University	79.6	67.3	84.5
Marquette University	79.2	65.8	83.1
Northwestern University	79.1	69.4	87.7
Loyola Marymount Univ	78.0	66.6	85.3
Princeton University	77.9	75.6	97.1
+ U District of Columbia	77.8	58.6	75.4
U Virginia	77.3	68.3	88.3
GMI Engrg & Mgmt Inst	76.3	60.2	78.9
Kansas State University	74.9	61.5	82.1
U Alabama	73.9	51.2	69.3
Colorado School of Mines	73.2	61.9	84.5
Syracuse University	72.6	58.2	80.2
Lawrence Technological U	72.2	54.3	75.3
U Pacific	71.9	67.6	94.0
Rensselaer Polytechnic	71.8	72.8	101.4
U Cal-Santa Barbara	71.6	68.5	95.6
U Notre Dame	71.6	66.8	93.3
U Delaware	71.6	55.5	77.5
SUNY-Buffalo Campus	71.5	66.5	93.0
U Arizona	71.3	46.6	65.4
U Minnesota	71.1	69.7	98.1
U Detroit	71.0	53.9	75.8
SUNY-Stony Brook Campus	71.0	54.7	77.1
U Bridgeport	70.5	75.4	106.9
U Missouri-Rolla	70.2	75.5	107.5
Ohio University	69.8	63.0	90.2
U Mississippi	69.8	66.0	94.6
Vanderbilt University	69.6	56.0	80.5
U South Carolina	69.3	62.3	89.8
Florida Institute of Tech	67.5	62.7	92.9
U Cincinnati	67.1	52.6	78.4
Auburn University	66.0	46.3	70.1
NM State University	65.9	42.1	63.8
Purdue Univ-W Lafayette	65.8	50.4	76.6
Virginia Poly Institute	64.8	51.2	79.0
NC State Univ-Raleigh	62.3	52.9	84.9
Lehigh University	61.7	44.5	72.1
U New Mexico	61.6	52.6	85.4
Oklahoma State Univ	60.8	40.9	67.3
Case Western Reserve Univ	60.7	52.5	86.4
U Mass-Amherst	60.3	51.3	85.2
Rutgers University	60.2	51.2	85.0
Louisiana State Univ	59.7	45.6	76.5
Illinois Inst of Tech	58.6	59.0	100.8
U Texas-El Paso	58.4	36.4	62.3
Penn State University	58.0	49.0	84.5
Iowa State University	57.6	45.1	78.4
Arizona State University	57.3	42.1	73.5
U Texas-Austin	57.3	47.8	83.5
Clemson University	55.7	46.3	83.1
Cornell University	54.3	56.0	103.1
U Pennsylvania	53.9	47.5	88.1
U Kansas	52.7	45.8	86.9
U Cal-Irvine	52.5	47.5	90.4
U Southern California	51.6	46.1	89.3
+ Tuskegee University	51.2	49.3	96.3
Boston University	49.2	42.2	85.8
Columbia University	49.1	52.3	106.6
U Toledo	48.2	37.2	77.1
U Texas-Arlington	48.1	42.4	88.2
U Wisconsin-Madison	46.9	42.4	90.5
U Connecticut	45.8	32.0	69.9
Ohio State University	45.6	34.7	76.1
Michigan State University	44.8	26.7	59.6
Christian Brothers Coll	44.6	28.3	63.4
U Oklahoma	44.5	27.8	62.5
Wright State University	41.7	41.0	98.3
Carnegie Mellon Univ	41.7	30.7	73.8
U Pittsburgh	41.4	38.5	93.0
U Arkansas	40.9	36.0	88.0
Embry-Riddle U-Daytona	39.9	30.9	77.5
U Michigan-Dearborn	39.5	35.7	90.5
Western Michigan Univ	38.7	26.0	67.1
Memphis State University	38.5	26.0	67.6
U Southwestern Louisiana	38.4	29.6	77.0
U NC-Charlotte	37.1	21.2	57.1
U Missouri-Columbia	36.6	38.7	105.9
U South Alabama	34.5	23.8	69.0
+ Southern University	34.0	30.3	89.1
U Houston	34.0	29.6	87.0
U Akron	32.0	15.7	49.0
U Alabama-Birmingham	26.9	42.0	156.0
Oakland University	10.8	11.4	105.5

*Selection Criteria: 1) Only schools with complete data. 2) A yearly average minority sophomore class of at least 10. 3) Increases in sophomore-to-junior enrollments do not exceed 15% for either minorities or nonminorities.

+ HBCU

Table 8
Engineering Colleges Ranked by Average Number of Minority Graduates

	Number of Minority Graduates
CCNY (City College CUNY)	109
* Howard University	99
Georgia Inst of Tech	94
* Prairie View A&M Univ	87
* NC A&T State University	84
Texas A&M University	83
* Tuskegee University	74
U Texas-Austin	69
U Florida	68
U Texas-El Paso	67
* Southern University	65
Cal State U-Long Beach	63
NC State Univ-Raleigh	60
U New Mexico	58
U Miami	58
# Mass Inst of Technology	58
NM State University	57
Florida Intl University	57
Pratt Institute	57
Cal Poly Pomona	54
Purdue Univ-W Lafayette	52
Stanford University	51
Texas A&I University	51
# New Jersey Inst Tech	48
Cornell University	45
* U District of Columbia	43
Polytechnic University	43
Rensselaer Polytechnic	41
* Tennessee State Univ	40
U Cal-Berkeley	39
U South Florida	39
U Maryland-College Park	39
Cal State U-Northridge	38
U Tennessee-Knoxville	36
U Arizona	35
U Illinois-Champaign	35
U Michigan-Ann Arbor	32
U Southern California	32
U Illinois-Chicago	31
Illinois Inst of Tech	31
Cal Poly-San Luis Obispo	30
Northwestern University	30
U Cal-Los Angeles	30
U Alabama	30
U Missouri-Rolla	28
Rutgers University	27
Manhattan College	27
Drexel University	27
Michigan State University	26
San Diego State Univ	26
GMI Engrg & Mgmt Inst	26
Ohio State University	25
# US Military Academy	24
Cal State U-Los Angeles	23
Stevens Inst of Tech	23
US Naval Academy	23
U Cal-Santa Barbara	22
Virginia Poly Institute	22
San Jose State University	22
U South Carolina	21
US Air Force Academy	21
U Washington	21
Mississippi State Univ	20
U Cal-Davis	20
Northeastern University	20
Clemson University	19
U Virginia	18
Boston University	18
Penn State University	18
Lawrence Technological U	18
# Florida Atlantic Univ	17
Princeton University	17
Arizona State University	17
Columbia University	17
Texas Tech University	16
U Central Florida	16
Auburn University	16
Marquette University	16
U Mass-Amherst	15
Tulane University	15
Cal State U-Sacramento	15
U Colorado-Boulder	15
U Houston	15
# U Texas-San Antonio	15
Louisiana State Univ	14
U Pennsylvania	14
U Wisconsin-Madison	14
Wayne State University	14
Syracuse University	14
Loyola Marymount Univ	13
U Arkansas	13
U Texas-Arlington	13
U Pittsburgh	13
San Francisco State Univ	13
Southern Methodist Univ	13
SUNY-Buffalo Campus	13
U Delaware	13
Rice University	12
Louisiana Tech University	12
U Minnesota	12
# Lamar University	12
Old Dominion University	12
Washington University	12
Florida Institute of Tech	11
# U Cal-San Diego	11
George Washington Univ	11
Fairleigh Dickinson Univ	11
Oklahoma State Univ	10
Kansas State University	10
Memphis State University	10
U Detroit	10
# U New Orleans	10
U Oklahoma	10
Colorado School of Mines	10
Iowa State University	10
U Kansas	10
Cal State-Fullerton	10
Colorado State University	10
SUNY-Stony Brook Campus	10
U Notre Dame	10
U Bridgeport	9
U Missouri-Columbia	9
Johns Hopkins University	9
Tennessee Tech Univ	9
Vanderbilt University	9
Catholic Univ of America	9
Cal State U-Fresno	9
Case Western Reserve Univ	9
# NY Institute of Tech	9
U Dayton	8
U Louisville	8
Santa Clara University	8
U Pacific	8
Duke University	8
Lehigh University	8
# FAMU/FSU College of Engrg	8
U Colorado-Denver	8
U Alabama-Huntsville	8
U Alabama-Birmingham	7
U Cal-Irvine	7
Ohio University	7
Michigan Tech University	7
U Southwestern Louisiana	7
U Hartford	7
Brown University	7
# George Mason University	7
U Mississippi	7
U Tulsa	7
ND State University	7
U Cincinnati	7
Harvard University	6
Cleveland State Univ	6
Purdue Univ-Calumet	6
* # Morgan State University	6
U Lowell	6
Oregon State University	6
Rochester Inst of Tech	6
Virginia Military Inst	6
Worcester Poly Institute	6
So Illinois-Edwardsville	5
Christian Brothers Coll	5
# Milwaukee School of Engrg	5
NM Institute of Mining &	5
U Connecticut	5
U Toledo	5

	Number of Minority Graduates
West Virginia University	5
U Michigan-Dearborn	5
Northern Arizona Univer	5
Wright State University	5
Carnegie Mellon Univ	5
Yale University	5
Cal State U-Chico	5
US Merchant Marine Acad	5
Bradley University	4
U New Haven	4
# College of Staten Island	4
U Rhode Island	4
U Wisconsin-Milwaukee	4
Widener University	4
So Illinois-Carbondale	4
West Coast University	4
U Utah	4
Cooper Union	4
# Temple University	3
Tufts University	3
U Kentucky	3
Villanova University	3
Embry-Riddle U-Daytona	3
Northrop University	3
St Mary's University	3
Trinity University	3
U Nevada-Reno	3
U Rochester	3
Cal Inst of Technology	3
Portland State Univ	3
Purdue Univ-Indianapolis	3
U Tennessee-Chattanooga	3
Union College	3
U NC-Charlotte	3
U South Alabama	3
Washington State Univ	3
Western Michigan Univ	3
Wichita State University	3
Brigham Young University	3
McNeese State University	3
Clarkson University	3
Gonzaga University	3
SD School of Mines & Tech	3
West Virginia Inst Tech	3
Harvey Mudd College	2
U Colorado-Colorado Springs	2
U Iowa	2
# Bridgeport Engrg Inst	2
Lafayette College	2
U Idaho	2
Walla Walla College	2
Rose-Hulman Inst of Tech	2
U Akron	2
# Hampton University	2
Bucknell University	2
# Central State University	2
Mass Maritime Academy	2
Valparaiso University	2
Youngstown State Univ	2
Oakland University	2
Parks College-St Louis U	2
Tri-State University	2
U Nebraska-Lincoln	2
SUNY Maritime College	1
Geneva College	1
Hofstra University	1
Montana State University	1
Western New England Coll	1
Southeastern Mass Univ	1
# SUNY College of Env Sci	1
Swarthmore College	1
U Hawaii	1
U Nevada-Las Vegas	1
U Wisconsin-Platteville	1
US Coast Guard Academy	1
Citadel	1
# Embry Riddle U-Prescott	1
Indiana Inst of Tech	1
U Evansville	1
U Portland	1
John Brown University	1
Monmouth College	1
Montana Coll Min Sci/Tech	1
U Georgia	1
Dartmouth College	1
# Miami University	1
Phila Coll of Textiles	1
St Martins College	1
U Maine-Orono	1
# U Southern Colorado	1
# Air Force Inst of Tech	1
Arkansas State University	1
Norwich University	1
# SUNY College at New Paltz	1
Texas A&M U-Galveston	1
U Alaska-Fairbanks	1
# U Scranton	1
U Vermont	1
Alfred University	0
Gannon University	0
Loyola College	0
Ohio Northern Univ	0
Seattle Pacific Univ	0
Seattle University	0
# SUNY-Binghamton Campus	0
# U Alaska-Anchorage	0
# U Nevada-Sch of Mines	0
U Redlands	0
Utah State University	0
# Alabama A&M University	0
# Baylor University	0
# Cogswell College North	0
# Mankato State University	0
New England College	0
# Northeastern State Univ	0
SD State University	0
St Cloud State University	0
# U Maryland-Baltimore	0
U Texas-Permian Basin	0
U Wyoming	0
Washington & Lee Univ	0
Arkansas Tech University	0
# Calvin College	0
Grove City College	0
Idaho State University	0
Le Tourneau College	0
Merrimack College	0
# Northern Illinois Univ	0
Pacific Lutheran Univ	0
Purdue Univ-Ft Wayne	0
# St Ambrose University	0
# U Minnesota-Duluth	0
U North Dakota	0
# US International Univ	0
Webb Inst of Naval Arch	0
# Wentworth Inst of Tech	0
# California Maritime Acade	0
# College of St Thomas	0
# Grand Valley State Univ	0
# Hartford Graduate Center	0
Humboldt State University	0
# Inst of Paper Sci & Tech	0
Marietta College	0
# Mercer University	0
# Messiah College	0
# Natl Tech University	0
# Oral Roberts University	0
# Oregon Grad Inst Sci/Tech	0
# U Akron-Polymer Sci	0
# U Cal-Santa Cruz	0
# U Denver	0
# U NC-Chapel Hill	0
U New Hampshire	0
# U Tennessee-Space Inst	0
# U Texas-Dallas	0
# U West VA-Grad Studies	0
# U Wisconsin-Parkside	0
# US Naval Postgraduate Sch	0
# Washington U (STIM)	0
Wilkes College	0

+ HBCU

Schools with incomplete graduation data

Table 9.
Engineering Colleges Performing Above Average Across All Measures Examined*

	Minority Graduation Rate (%)		Relative Retention Index (%)		Yearly Average Number of Minority Graduates
	Freshman-Based	Sophomore-Based	Freshman-Based	Sophomore-Based	
Drexel University	55.1	67.3	68.0	79.6	37
GMI Engrg & Mgmt Inst	44.1	60.2	69.2	76.3	26
Loyola Marymount Univ	42.1	69.6	82.3	79.0	13
Marquette University	58.7	65.8	87.5	79.2	16
Northwestern University	75.7	89.4	79.3	79.1	30
Princeton University	71.4	75.6	77.9	77.9	17
Rensselaer Polytechnic	54.7	73.3	86.0	74.4	41
Stevens Inst of Tech	55.7	68.1	83.2	80.3	33
SUNY-Buffalo Campus	47.6	70.5	79.2	71.5	13
Texas A&I University	53.3	71.2	77.9	84.5	61
Tulane University	72.3	78.1	76.6	80.2	16
U Colorado-Boulder	60.4	73.9	77.9	83.0	19
U Missouri-Rolla	43.2	79.5	76.6	71.2	28
U Tennessee-Knoxville	57.6	69.7	85.7	81.6	30
U Virginia	42.2	68.2	83.1	77.3	19

*Selection Criteria: 1) Only schools with complete data; 2) Above average graduation rates for both freshman and sophomore cohorts; 3) Above average relative retention indices for all measures; 4) An average of at least 13 minority graduates per year; 5) Classes in which minority representation is low and enrollments fluctuate greatly are excluded because annual enrollments do not exceed 15%.

Table 10.
Engineering Colleges with a Graduating Class of at Least 25 African Americans*

	Average Annual African American Graduates	
	Number	Percent
• Howard University	99	87.6
• Prairie View A&M Univ	87	[illegible]
• NC A&T State University	83	63.3
• Tuskegee University	74	86.0
CCNY (City College, CUNY)	70	20.2
Georgia Inst of Tech	65	5.7
• Southern University	64	45.7
NC State Univ-Raleigh	51	5.3
Pratt Institute	42	27.0
• Tennessee State Univ	40	49.6
Purdue Univ-W Lafayette	38	3.0
• U District of Columbia	37	50.6
U Tennessee-Knoxville	31	5.7
U Alabama	27	3.2
Northwestern University	27	3.4

*Selection Criteria: 1) Only schools with complete data.

Table 11.
Engineering Colleges with a Graduating Class of At Least 25 Hispanics*

	Average Annual Hispanic Graduates	
	Number	Percent
Texas A&M University	67	4.8
U Texas-El Paso	66	37.3
U Texas-Austin	58	7.0
NM State University	53	20.3
U New Mexico	52	18.4
Texas A&I University	50	33.7
U Miami	50	19.0
Ca. Poly.-Pomona	42	9.2
CCNY (City College, CUNY)	39	11.4
Ca. State U-Long Beach	38	6.0
U South Florida	28	7.4
U Arizona	27	5.1
Georgia Inst of Tech	27	2.3
Stanford University	27	3.4

*Selection Criteria: 1) Only schools with complete data.

	Change in Average Annual Hispanic Enrollment		
	Sophomore to Junior (%)	Number Sophomores	Juniors
Cal State U-Sacramento	146.3	11	27
U Central Florida	130.5	10	23
Cal State U-Long Beach	123.8	28	63
U South Florida	97.2	18	35
San Diego State Univ	73.6	21	37
Cal State U-Fresno	67.0	15	25
Cal Poly-Pomona	56.3	37	58
San Jose State University	51.8	14	21
Pratt Institute	42.9	13	18
U Washington	41.4	10	14
U Mass-Amherst	21.5	11	13
Texas A&M University	21.1	84	102
U Cal-Los Angeles	19.8	28	33
Georgia Inst of Tech	18.4	26	31
U Miami	18.2	50	60
Manhattan College	18.1	21	25
U Illinois-Champaign	17.6	17	20
Cal State U-Los Angeles	15.4	22	25
Illinois Inst of Tech	15.1	12	14

*Selection Criteria: Only schools with complete data

	Average Annual American Indian Graduates	
	Number	Percent
U New Mexico	5	1.6
U Tulsa	2	1.5
U Nevada-Reno	1	1.3
NM Institute of Mining	1	1.4

*Selection Criteria: Only schools with complete data

Appendix
Engineering Manpower Commission Data: All Engineering Colleges 1980-81 through 1989-90

	Number of Schools	Freshman Enrollment		Sophomore Enrollment		Number of Schools	Graduates	
		Minority	Nonminority	Minority	Nonminority		Minority	Nonminority
1980-81	286	10,399	98,915	NA	NA	NA	NA	NA
1981-82	285	11,116	103,085	6,861	79,956	NA	NA	NA
1982-83	285	10,721	103,796	6,974	81,977	NA	NA	NA
1983-84	291	10,603	98,160	7,052	81,711	FNA	3,817	72,759
1984-85	288	10,594	93,780	6,863	76,331	288	3,883	73,646
1985-86	296	10,588	91,697	6,832	71,939	302	4,107	73,708
1986-87	312	NA	NA	6,286	69,053	308	4,171	71,048
1987-88	NA	NA	NA	NA	NA	314	4,318	66,547
1988-89	NA	NA	NA	NA	NA	317	4,310	63,981
1989-90	NA	NA	NA	NA	NA	325	4,242	61,209
Average	292	10,670	98,239	6,811	76,828	309	4,121	68,985

*Excluding the University of Puerto Rico. NA - Not Applicable. FNA - Figure Not Available

Appendix B.

Engineering Manpower Commission through 1989-90*

	Number of Schools	Freshman Enrollment		Sophomore Enrollment		Graduates	
		Minority	Nonminority	Minority	Nonminority	Minority	Nonminority
1980-81	231	9,496	88,749	NA	NA	NA	NA
1981-82	231	10,329	92,393	6,295	71,709	NA	NA
1982-83	231	10,319	93,857	6,619	74,756	NA	NA
1983-84	231	9,843	86,256	6,482	72,518	3,210	63,335
1984-85	231	9,569	82,817	6,079	67,962	3,261	64,724
1985-86	231	9,148	81,989	5,855	63,864	3,577	64,325
1986-87	231	NA	NA	5,576	60,925	3,603	61,596
1987-88	231	NA	NA	NA	NA	3,703	57,702
1988-89	231	NA	NA	NA	NA	3,556	55,506
1989-90	231	NA	NA	NA	NA	3,494	52,845
Average		9,784	87,677	6,151	68,622	3,486	60,005

*Excluding the University of Puerto Rico. Cal Poly Pomona, Columbia University, Cornell University and Stevens Institute of Technology provided missing data to NACME
NA - Not Applicable

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National Action Council for Minorities in Engineering, Inc.
3 West 35th Street
New York, NY 10001-2281

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President

Lea E. Williams, Ed.D.
Executive Vice President

Ronni Denes
Vice President, Communications and Public Affairs

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Vice President, Resource Development

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